International Islamic University Chittagong
Department of Economics & Banking
Final Examination; Spring-2019
Program: BSS (Honors)

Course Code: MATH-2302 Course Title: Mathematical Economics
Time: 2.5 Hours Full Marks: 50

Answer any Five of the following questions. All parts of a question must be answered sequentially. Figures in the right margin indicate full marks.

1. (a) What is Input-Output Analysis? What are the assumptions of Leontief's Input-Output Model? 10
   (b) What is input coefficient matrix? Consider the following example- an economy is based on three sectors- Agriculture, Transport & Energy. Production of a dollar's worth of agriculture requires an input of \$0.30 from agriculture sector, \$ 0.20 from Transport & \$0.10 from energy sector. Production of a dollar's worth of Transport sector requires an input of \$0.30 from agriculture, \$0.10 from transport & \$0.30 from energy sector. And finally Production of a dollar's worth of energy requires an input of \$0.20 from each sector
   (i)Construct the relevant input coefficient matrix.
   (ii) Write the meanings of a_{21}, a_{33}
   (iii)Write the meaning of 2nd column & 2nd row sum?
   (iv)Find the primary input coefficients.

2. Consider the following input coefficient matrix and the final demand vector:

$$A = \begin{bmatrix} 0.1 & 0.5 & 0.2 \\ 0.6 & 0 & 0.3 \\ 0.2 & 0.4 & 0.15 \end{bmatrix}; d = \begin{bmatrix} 10 \\ 20 \\ 30 \end{bmatrix}$$

   i) Write the economic meanings of 0 and 30. 1
   ii) What is the meaning of second column sum? 1
   iii) Find the optimal (solution) output levels of three industries. 6
   iv) Find the total primary input requirement. 2

3. (a) Define constrained optimization with example. 2
   (b) Minimize a cost function ,C = 3L + 5K , subject to an output constraint ,Q= KL=1000 8

4. (a) A consumer faces a utility function: U = (x,y) =2xy, where x and y are the consumption of two goods X and Y, whose prices are 2 taka and 5 taka respectively. Find the optimum consumption level of X and Y and the amount of maximum utility of the consumer who spends 500 taka. 8
   (b) Interpret the meaning of Lagrangian multiplier in the above problem. 2

5. a) What is a homogenous function? Distinguish between homogeneous and homothetic function with example. 4
   b) Test the homogeneity of the following functions: 6
   (i) $Z = f(x,y) = x^2 - 2xy^2 + y^3 + 10x - 12y + 60$
   (ii) $C(x,y) = 9x^3 - 72xy + 9y^2$

6. Suppose, the production function $Q = AK^{\alpha}L^{\beta}$ $(0 < \alpha, \beta < 1)$
   i) Test the homogeneity of the function. 2
   ii) Mention the conditions at where it will follow increasing, decreasing and constant returns to scale. 1
   iii) Show that both average and marginal products are the function of K/L. 4
   iv) Show that it satisfies the Euler's Theorem. 3

7. Given, Cobb Douglas production function, $Q = AK^{0.3}L^{0.7}$ (A>0)
   i) Find marginal and average products of both factors. 4
   ii) Compute the share of each factor in total production. 3
   iii) Show that the expansion path would be straight line passing through the origin 3